Looking for young planetary systems with K2 and VLT/SPHERE

Arthur Vigan
Laboratoire d'Astrophysique de Marseille

We propose to join the forces of K2 from space and SPHERE at the VLT to detect planetary systems around 8 young (25-600 Myr), nearby (3-60 pc) stars, which are part of our 200-nights direct imaging survey that will be conducted with SPHERE guaranteed time over the next 5 years.

Exoplanet detection methods all have their specificities, both in terms of observable target properties (age, distance, spectral type) and sensitivity to planets (mass, radius, period). These domains are often disjoint, and there are very few systems where we have a global view from very short to very long separations. This is particularly true for young planetary systems, which are generally not targeted by radial velocity (RV) due to the higher variability of the star, but are the primary targets for the direct imaging method due to the higher intrinsic flux of young giant planets (Baraffe et al. 2003, A&A, 402, 701). We propose to start filling up this void by using two powerful planet hunter instruments, K2 and SPHERE.

Any joint detection of a planetary system with K2 and SPHERE would be a major discovery and constitute a "Rosetta stone" system for the study and understanding of migration processes and interactions in planetary systems. This is a central question for systems with giant planets at wide orbital separation, for which the far out location could be the result of migration processes through gravitational interactions with other planets in the system. Investigating such mechanisms in a confirmed detected planetary system would be a great achievement.

K2 observations will provide unprecedented access to the innermost orbital regions around these stars, allowing the identification of small planet candidates within ~0.3 AU. The high-contrast and high-angular resolution SPHERE observations will give access to the outermost regions (5-50 AU) of these systems, where it will be sensitive down to low-mass brown dwarfs and giant gaseous planets. In addition to providing sensitivity to young giant planets, SPHERE will also decrease the probability of astrophysical false-positives in the K2 data by background objects to extremely low levels, which will facilitate the validation of detected planetary candidates.

In summary, we want to look for young planetary systems using two powerful exoplanet-hunting instruments, K2 and VLT/SPHERE. We propose to observe 8 stars with ages <600 Myr that will fall into the K2 Fields #6 and #7. All but one have late spectral types and a Kepler magnitude Kp<10. We ask for long-cadence data for all targets.